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Taste; astringent, sweetish astringent, saline, alkaline, cooling, bitter, sour. (b) Odor: alliaceous, sulphurous, fetid, argillaceous. (c) Solubility; water, acids, alkalies. (d) Fusibility; scales of. (e) Volatility; volatile, partially volatile, non-volatile.

2. Laboratory processes.
3. Field study and collections.
4. Laboratory study of collections.
5. Tabulating and condensing results for future reference.

**Introduction to the Study of Soil Formations.** 1. Mechanical separations: (a) Mineral. (b) Organic.

2. Physical and chemical separations: (a) Fluid, solid. (b) Separation of fluids into chemical constituents. (c) Separation of solids into chemical constituents.

3. A study of the properties of the chemical constituents.

**Introduction to the Study of Animal and Vegetable Formations.** 1. Physical and chemical separations: (a) Fluid, solid. (b) Separation of fluid parts into chemical constituents. (c) Separation of solid parts into chemical constituents.

2. A study of the properties of the chemical constituents.

**III. Books of Reference.** *Elementary Chemical Science*, Jackman, W. S. *Nature Study for Grammar Schools*, Jackman, W. S. *Field Work and Nature Study*, Jackman, W. S. *Nature Study Record*, Bower, J. W. *Simple Experiments for Science Teaching*, Roscoe—*Chemistry* (Science Primer Series). Collins, J. H. *A First Book on Mineralogy*, Faraday, M. *The Chemical History of a Candle*, Appleton, J. H. *Chemistry*, Memsen, I. *An Introduction to Study of Chemistry*, Remsen, I. *A Laboratory Manual*, Remsen, I. *Organic Chemistry*, Orndorff, W. R. *Laboratory Manual, Organic Chemistry*, Coit, J. M. *Chemical Arithmetic*, Cross, G. M. *Chemical Technics*, Williams, R. P. *Elements of Chemistry*, Williams, R. P. *Laboratory Manual*, Shepard, J. H. *Elements of Chemistry*, Wiley, H. W. *Principle and Practice of Agricultural Chemistry*, Church, A. H. *The Laboratory Guide*.

# Study of Animal Life

## Ira B. Meyers

The work in zoölogy will be confined largely to a study of œcological relations as determined by Chicago environs, and illustrated by the field about Winnetka.

The various features of a landscape—facing, altitude, soil, moisture, temperature, and vegetation—are factors in the problem of adaptation to the animal life of the area. It is the aim of the field work to observe conditions under which animal life exists in any given area, and to note the influence of constant and varying factors upon its habits, characteristics, and life history.

The museum and laboratory work aims to aid the œcological studies of the field by (a) closer and more detailed observation of minute forms and structures; (b) study of internal structures; (c) continued observation of living forms through aquarium and cage; (d) comparing homologous structures and functions of allied forms.

Physiographic features: Lake, sand, and pebble shore; shore bluff; prairie; swamp.

Botanical features. (See Botany Outline.)

Zoölogical groups: Insects; crustaceans; batrachians; reptiles; birds; mammals.

General observations: Forms found in each special physiographic feature: (a) Dominant forms. (b) Occasional forms.

Range: Forms unrestricted in extent of range. Forms restricted to a particular part of the area. Forms attracted by some physiographic feature of the area—permanent residents. Forms attracted by seasonal food—temporary residents.

Movement: Demands for movement; range; factors influencing movement. Modifications of organs of locomotion: (a) As affected by the different media. (b) As affected by some peculiar aspect of the same medium. (c) As modified by peculiarity of habit.

Laboratory: A study of organs of locomotion.

Museum: Comparison of organs of locomotion. Field or zoölogical study of locomotion of living forms.

Food: Condition of food: Liquid or solid. Character of food: Vegetable, animal, mixed. Vegetable food: Method of locating food. (a) Kind of plant. (b) Part of plant. (c) Effect of injury upon plant. Plant's attempt to resist injury. Length of time food part is available; relation to life of animal. Animal food: Methods of locating food; methods of securing food.

STRUGGLE FOR EXISTENCE.
Botanical Field at Winnetka.

Laboratory: Study of sense organs.

Museum: Comparison of organs of prehension and mastication.

Field and Zoölogical Gardens—Animal feeding.

Protection: 1a. Adaptations enabling individual groups to maintain their position among the varied forms. (a) Forms adapted to area inaccessible to other forms. (b) Specially constructed homes or shields. (c) Special organs of protection. (d) Nauseous secretions. (e) Cunning or swiftness. (f) Color protection. (g) Without visible means of protection. 1b. Adaptations enabling groups to resist seasonal changes, such as temperature and moisture.

Laboratory and Museum: Study of protective organs and animal coverings.

Field Zoölogy: Study of life habits as related to means of protection.

Homes; home life of animals. (a) Living: Isolated, in pairs, in colonies. (b) Influences determining mode of living. (c) Living in specially constructed homes. (d) Dependent upon accidental shelter—crevices, holes, deserted homes, etc. (e) Changing growing vegetation into homes; insect galls. (f) Methods of caring for young. (g) Songs, call notes, etc.; purpose, methods of producing.

Animal life as related to man: Noxious and economic forms.

References: *Origin of Species,* Darwin. *Island Life,* Wallace. *Insect Life,* Comstock. *Animal Life,* Thompson. *Nature Study in Common School,* Jackman.

## Botanical Field in the Winnetka-Glencoe Area.

### I. Study of the Characteristic Plant Societies of the Region as They are Related to Topographic Features of the Region.

Crest of bluffs: Characteristic trees, shrubs, and herbs. Undrained depressions on bluffs. Characteristic trees, shrubs, and herbs. Slopes of ravines. River bottom. Stream bed.

Lake cliff: (a) Old cliff with an established vegetation. (b) Young cliff.

Present beach: (a) Lower beach. (b) Middle beach. (c) Upper beach.

Old beach ridges. (Ancient shore lines of Lake Chicago.) Depression between beach ridges. Swamp to westward.

*Questions:* Why such differences in flora? Are the conditions of the given area favorable for plants? What are the controlling factors in each case? How explain striking similarity between the Lake cliff flora and that of the sand dunes at Dune Park? Why is the cedar, pine, juniper combination characteristic of the Lake cliff area and not of other regions? Significance of present distribution of the sugar maple? the button bush? the shepherdia? the hop hornbeam? the wire-grass? the blue-grass? the mosses? etc.

### II. Conditions Which Have Had Influence in Determining the Different Plant Societies at Winnetka.

1. Soil Conditions. Chemical nature of soil. Physical nature of the soil. Stability. Porosity. Capacity for obtaining water. Capillarity. Deliquescence. Capacity for retaining water. Amount of soil-water available for plant uses. Tenacity. Injury done by cracking of clay soil. Ease or difficulty with which roots enter soil. Differential weathering of bowlders in the soil. Acid excretions from roots of plants.

*Questions*, such as: What are the soil conditions most favorable for plants? What plant adaptations can be traced to soil conditions?

2. Atmospheric Conditions. Chemical nature of the atmosphere. Physical nature of the atmosphere. Water of the atmosphere. Movements of the atmosphere.

*Questions:* What constituents of the atmosphere are used by plants? How are these obtained? What influence does the amount of moisture in atmosphere have upon transpiration? Influence of air movements. What plant adaptations can be traced to atmospheric conditions?

3. Heat Conditions. Average temperature during growing season. Extremes of temperature in air and soil.

4. Light Conditions. Total amount of light received in various situations. Direction of light.

*Questions:* What differences in the plant societies may be due to differences in heat and light conditions? Significance of the distribution of the delicate mosses? Vernal habits of forest herbs? Account for layers in the vegetation of the forest. What difference in structure between plants grown in shade and those grown in direct sunlight?

### III. History of the Different Plant Societies of Winnetka as it is Related to the History of the Topographic Features.

1. The original flora of each topographic feature.

2. The topographic changes which have brought about the present flora.

3. Changes going on at present which will influence the flora found at Winnetka. (a) Change from steep to gradual slopes. Increased stability of soil conditions. Accumulation of humus. (b) Widening of ravines. Increased exposure to heat, light, and wind. (c) Deepening of ravines. Lowering of underground water level in slopes. (d) Formation of wider flood planes, deltas, etc. (e) Filling in of swamps and undrained depressions.

4. The probable future of the flora associated with each topographic feature of the region.

# Department of History and Literature

## Emily J. Rice

The purpose of the courses in history and literature is to give special training in the selection of subject-matter suitable for use in elementary and secondary schools and the philosophy of methods of teaching these subjects. With this end in view, opportunities are offered for the study of historic material and for independent research and investigation of principles on which the teaching of history and literature is based.

The courses in this department are closely related to those in geography, art, dramatic expression, economics, and social science. The geographical laboratory is supplied with physiographic maps which will aid students in the interpretation of political and social data. Particular attention will be given to local history, and excursions in the city and vicinity will be made the basis for a study of economic and social conditions.

The department is supplied with a good collection of pictures, tools, and implements of primitive people, and with illustrations of the development of the industrial arts. The course includes a study of typical stories of different nations and periods of history; principles of presentation of these stories to children; relation of